

RESEARCH DEPARTMENT

U.H.F. TRANSMITTING AERIAL FOR THE BLACK HILL TELEVISION STATION

Technological Report No. E-119/3
UDC 621.396.712 1966/51

G.H. Millard, B.Sc., A.Inst.P.

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for Head of Research Department

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U.H.F. TRANSMITTING AERIAL FOR THE BLACK HILL TELEVISION STATION

INTRODUCTION

A u.h.f. transmitting aerial for the Lanarkshire area has been built on the support column of the existing ITA mast at Black Hill. The aerial came into operation with trade transmissions on 11th June 1966 and started full service on 9th July 1966.

SUMMARY OF INSTALLATION

- Site: The site is 25.7 km (16 miles) east of Glasgow, grid reference NS 829 648, height 274 m (900 ft) a.m.s.l.
- Support Structure: The support structure is a 305 m (1000 ft) stayed mast of square cross-section having a side of 1.52 m (5 ft). The mast stays are on bearings of 87°, 177°, 267° and 357° ETN.
- General Arrangement: See Fig. 1.
- Channels: The aerial is designed to radiate the two BBC channels, 40 and 46, of which the latter is used for the opening service (BBC-2). Both channels have negative offset.
- Aerial: The aerial comprises eight tiers, each of four 3.3λ panels, giving a total radiating length of 25.4λ at Channel 40 and 27.4λ at Channel 46. The panels are mounted on the corners of the support mast so that they radiate tangentially to the mounting circle. They are fed with currents of equal amplitude; on Channel 40 the currents alternate in phase round the mast but are in phase rotation on Channel 46. Each panel is provided with a glass-fibre weather shield. Figs. 2 and 3 show the arrangement of the panels on the mast and Fig. 4 shows the construction of each panel.
- The mean height of the aerial is 268 m (880 ft) a.g.l.
- Feeders: The arrangement of the distribution feeder is shown schematically in Fig. 5. Each half of the aerial is connected to the transmitters by a feeder type F and G $4\frac{1}{2}$ - 50.
- Power: Two 25 kW vision transmitters and two 5 kW sound transmitters will be provided for each channel; at present only those for Channel 46, manufactured by Pye, have been installed. Each transmitter will be run at the power required to give the maximum effective radiated power (e.r.p.) permitted under the Stockholm Agreement, namely 500 kW.
- Each vision transmitter is combined with a sound transmitter and the combined outputs are paralleled by means of a diplexer followed by a splitter transformer in order to eliminate differences between the modulation characteristics of the vision transmitters. A two-channel combining unit will be added later, as required.
- Templet and horizontal radiation pattern (h.r.p.): The h.r.p. was required to be omni-directional with a maximum e.r.p. not exceeding 500 kW. The specified tolerance on the h.r.p. uniformity was ± 2 dB. The h.r.p.s at the vision carrier frequencies of the two operational channels, which are shown in Figs. 6 and 7, are the mean of measurements made at the contractors test site on each half of the full-scale aerial.

Vertical radiation pattern (v.r.p.): The v.r.p. was specified to be gapfilled with the maximum of radiation tilted 0.5° below the horizontal; this is achieved by means of the following theoretical phase distribution over the length of the aerial, starting from the top.

Tier:	1	2	3	4	5	6	7	8
Current:	0	-9°	-13°	-68°	-106°	-44°	-60°	-69°

The v.r.p.s obtained for each face, shown in Figs. 8 - 11, were computed from measurements of the amplitudes and phases of the feeds to the aerial panels, taken after erection.

Gain:	Channel	40	46
		dB	dB
	Mean intrinsic gain	14.7	15.1
	<u>Deduct aerial losses:</u>	dB	dB
	Gapfilling	1.0	1.0
	Phasing units	0.1	0.1
	Distribution feeder	0.2	0.2
	Distribution transformers	0.1	0.1
	Balance loads	0.1 1.5	0.1 1.5
	Mean net gain	13.2	13.6
	<u>Deduct other losses</u>		
	Main feeder, 300 m (980 ft)		
	F and G $4\frac{1}{2}$ - 50	2.3	2.4
	Feeder ground run	0.2	0.2
	Diplexer	0.1	0.1
	Splitter	0.1 2.7	0.1 2.8
	Mean effective gain	<u>10.5</u>	<u>10.8</u>
	H.R.P. maximum/mean ratio	2.4	1.7
	Maximum effective gain	<u>12.9</u>	<u>12.5</u>
<u>Programme feed:</u>	GPO link		

ACKNOWLEDGEMENTS

The mechanical and electrical design, construction and setting to work of the aerial were carried out by the Marconi Co. Ltd. The contracting authority was the BBC Transmitter Planning and Installation Department.

REFERENCES

1. Detailed information on the construction and dimensions of the aerial is given on the following drawings held by Transmitter Planning and Installation Department:

Marconi Drawings

Band V Mark III Panel Aerial	T80 - 5160 Sh. 1
Arrangement of panels	T80 - 5700 Sh. 1
Arrangement of distribution transformers	T80 - 5700 Sh. 2
Arrangement of distribution feeder	T80 - 5700 Sh. 3

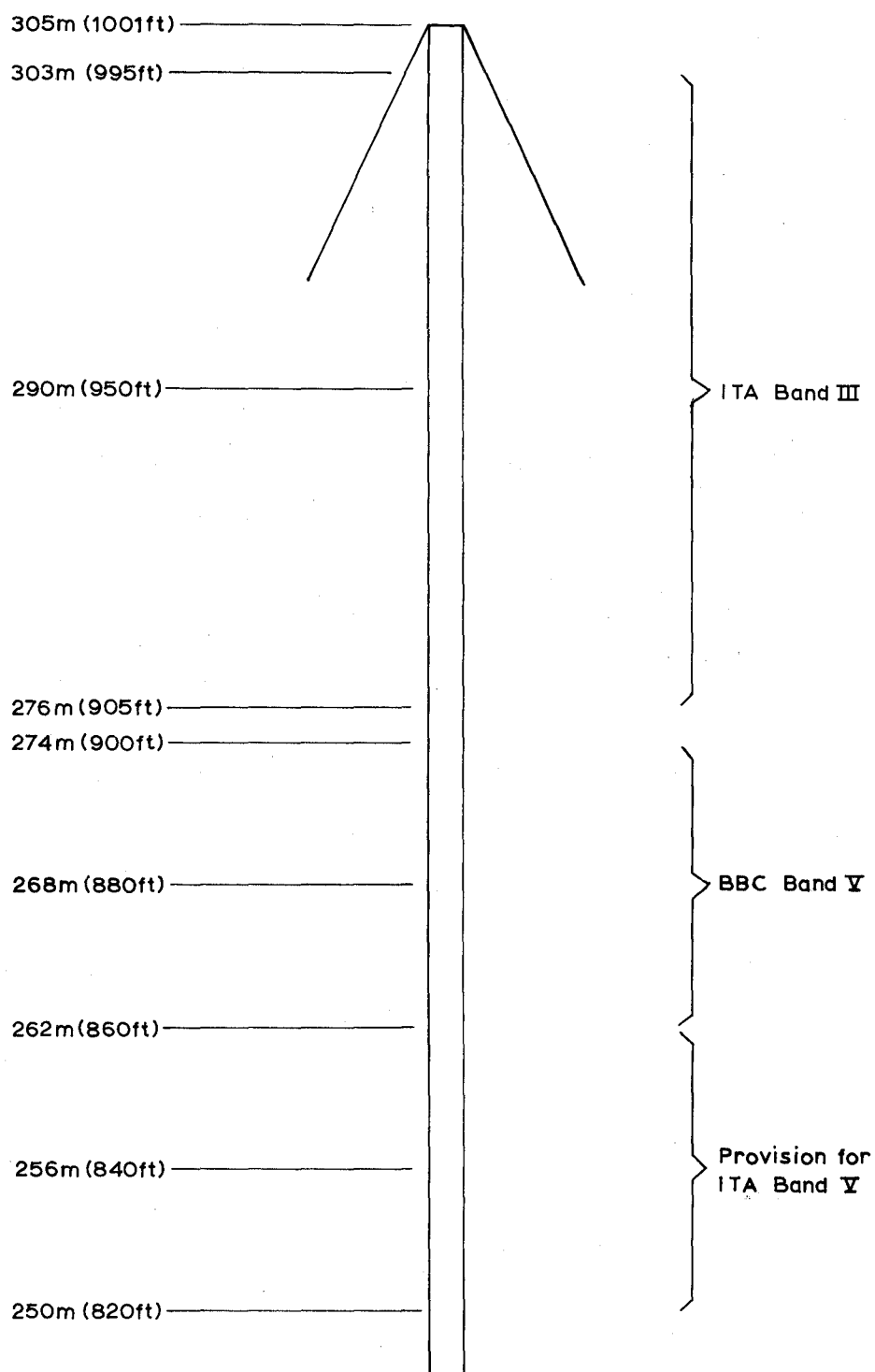


Fig.1. General arrangement of aerals on mast

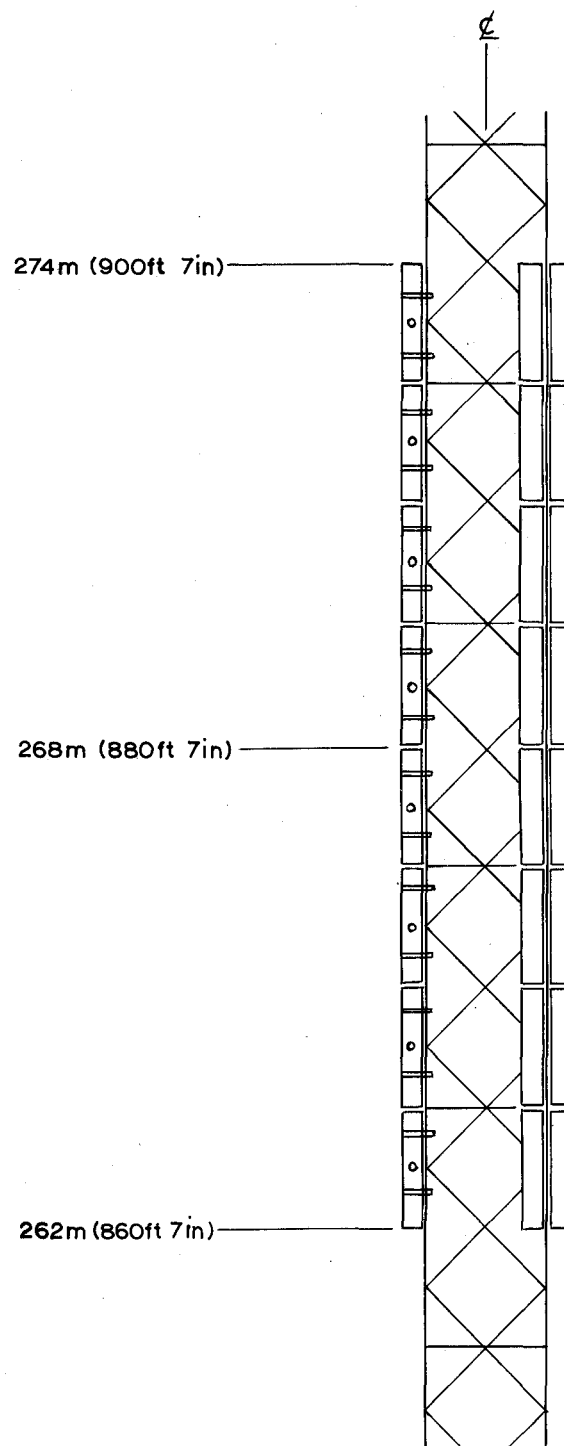


Fig. 2. Elevation of aerial

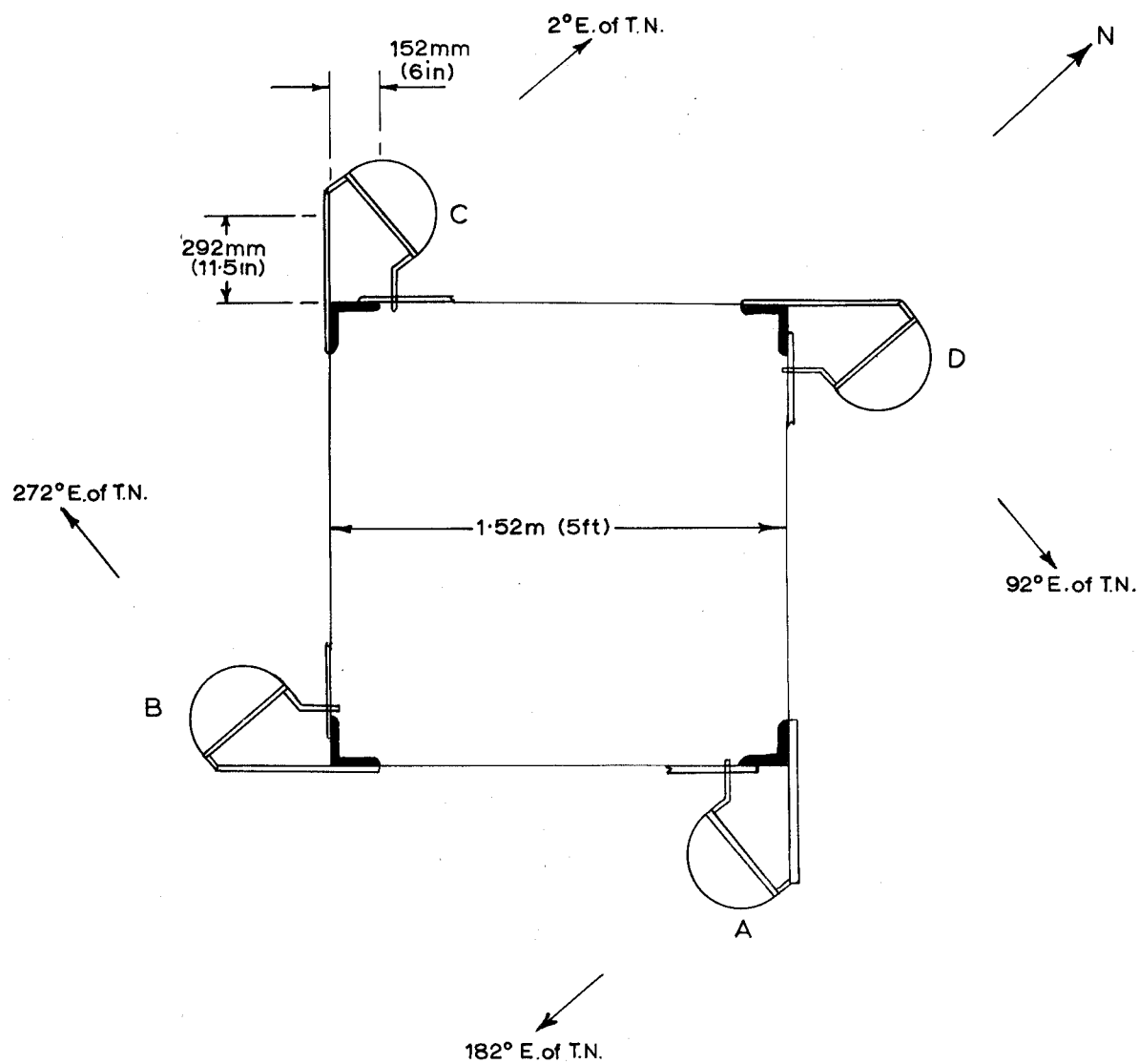


Fig.3. Plan of aerial

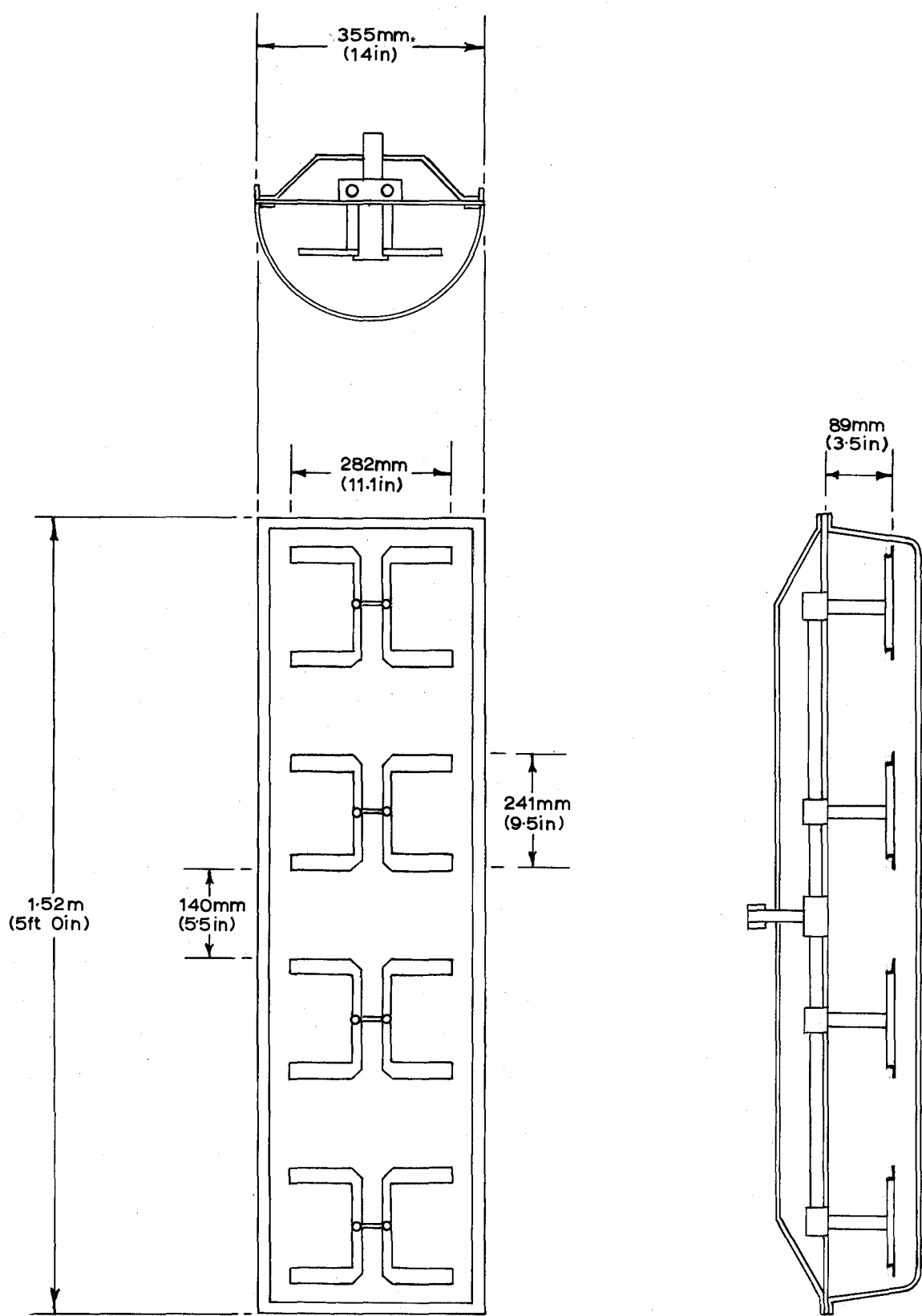


Fig.4. Construction of single panel

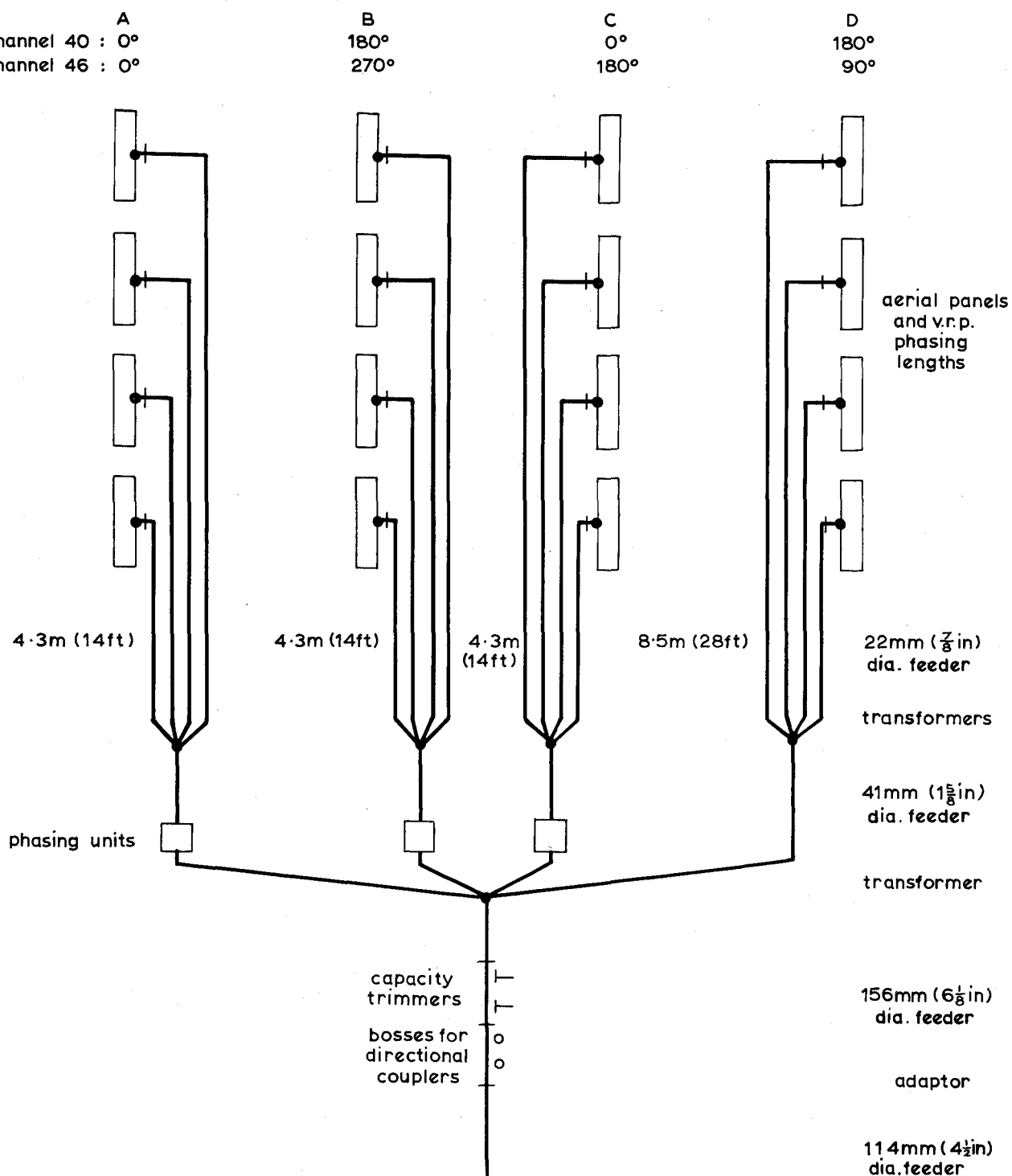


Fig.5. Arrangement of distribution feeder (one half aerial)

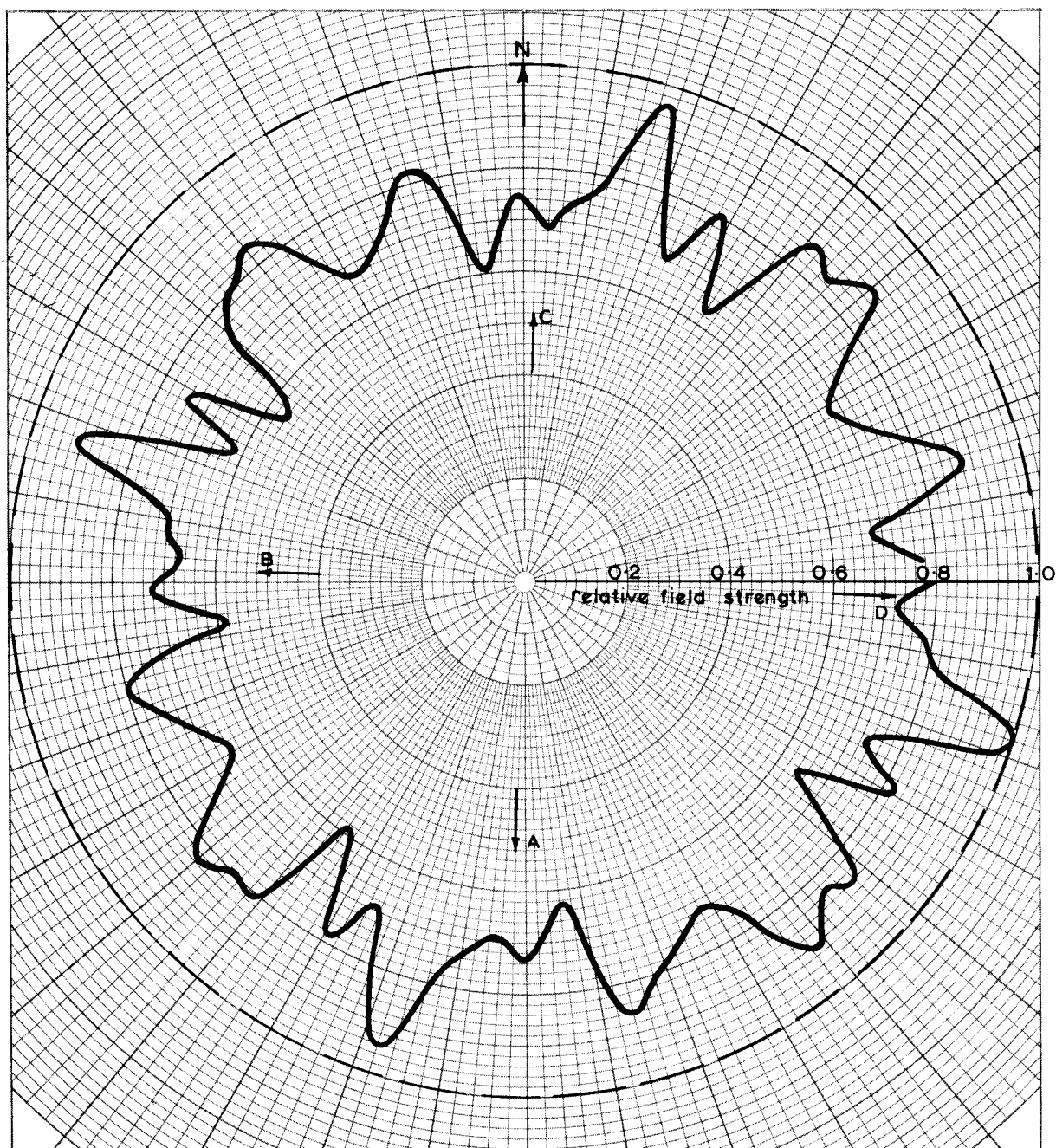


Fig. 6. Horizontal radiation pattern : Channel 40

HORIZONTAL POLARIZATION

Vision carrier : 623.25MHz , Sound carrier : 629.25MHz

Mean effective gain : 10.5dB

Peak vision transmitter power : 2x13kW

Mean E.R.P. : 290kW

— — — — — Stockholm E.R.P. limit

Unit field corresponds to an E.R.P. of 500kW

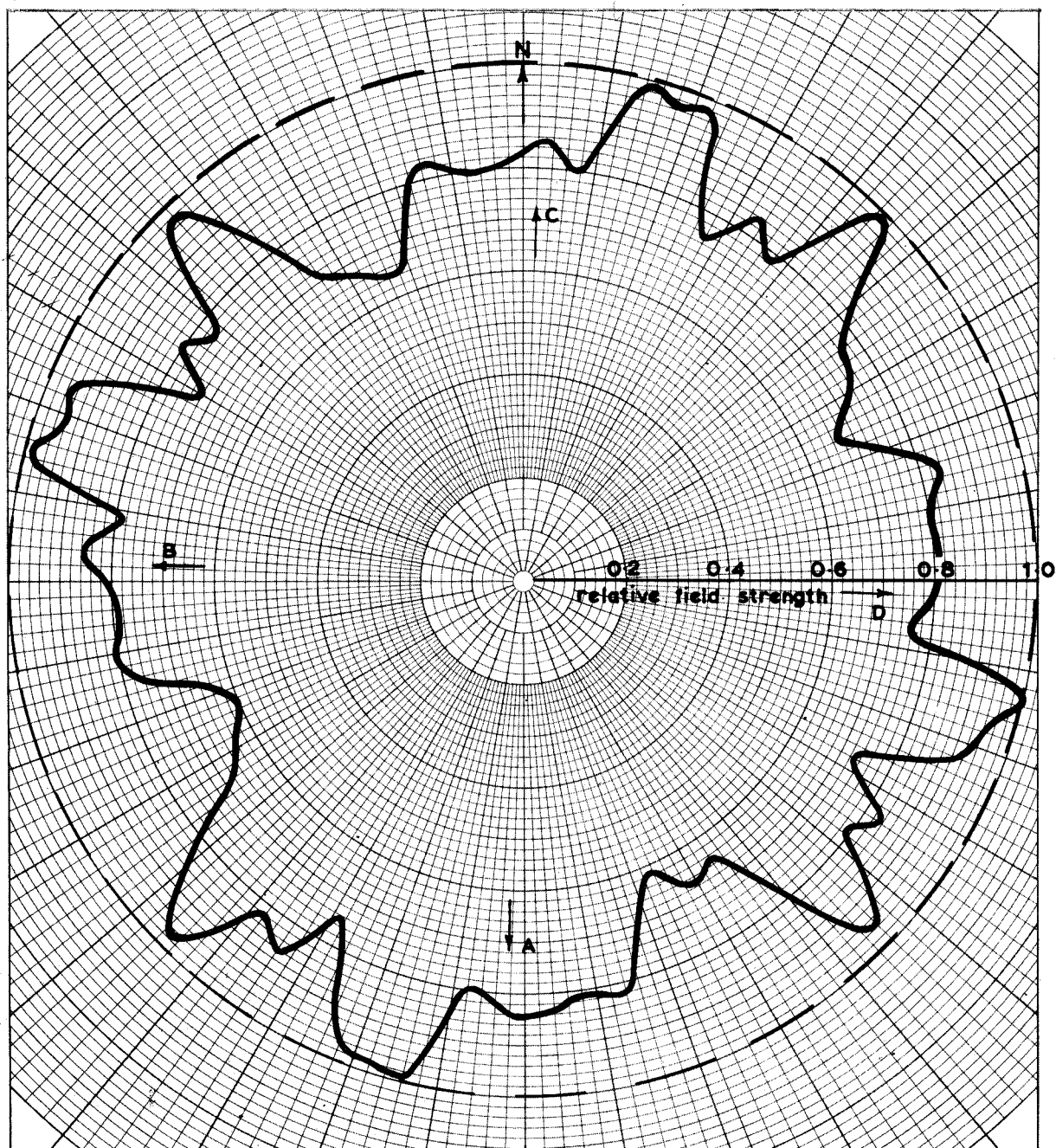


Fig.7. Horizontal radiation pattern: Channel 46

HORIZONTAL POLARIZATION

Vision carrier : 671.25MHz , Sound carrier : 677.25MHz

Mean effective gain : 10.8dB

———— Stockholm E.R.P. limit

Peak vision transmitter power : 2x14kW

Mean E.R.P. : 335kW

Unit field corresponds to an E.R.P. of 500kW

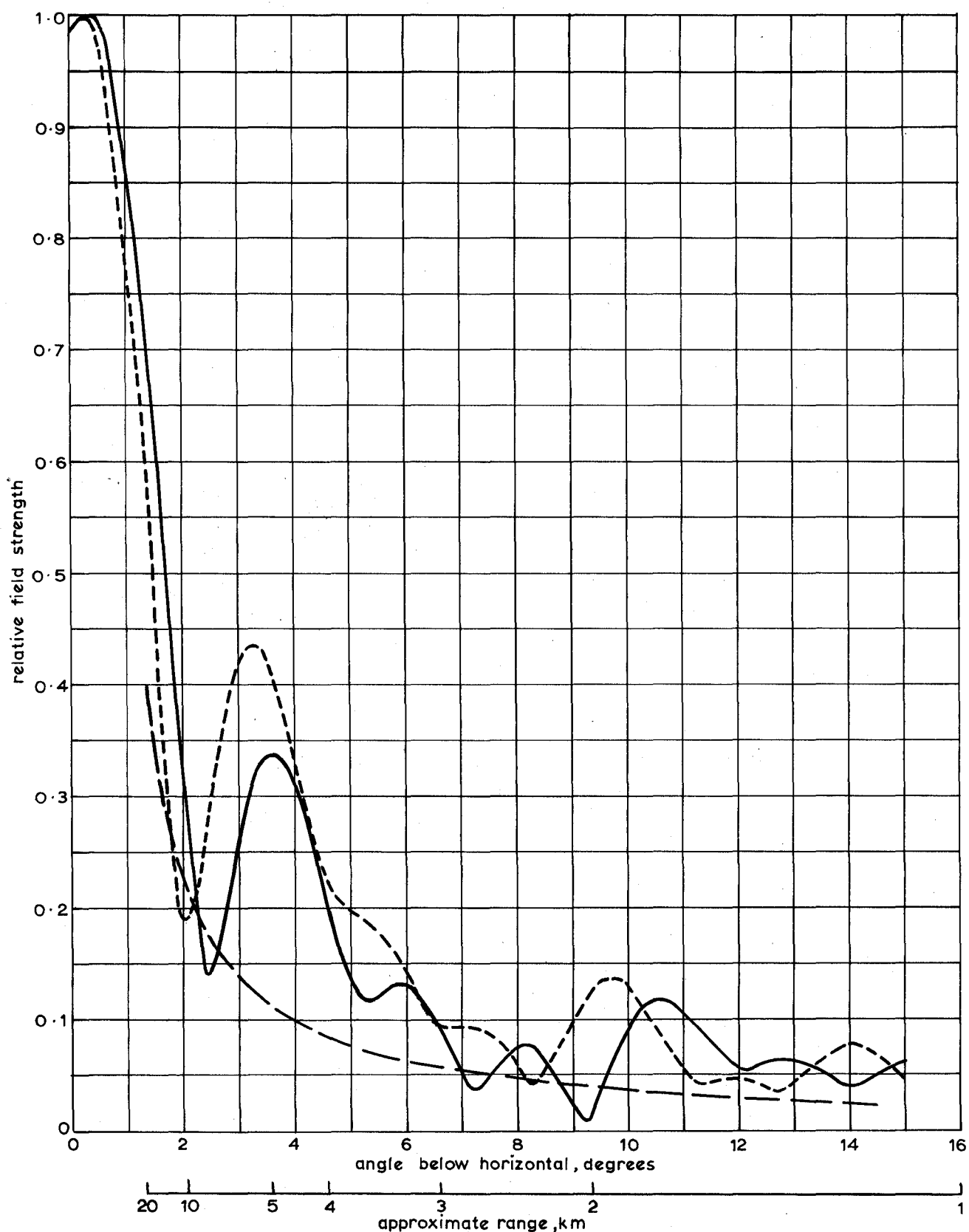


Fig.8. Vertical radiation pattern on bearing 2° E.T.N. (Leg C)

————— Channel 40 - - - - - Channel 46 (BBC 2)
 - . - . - Specified minimum field

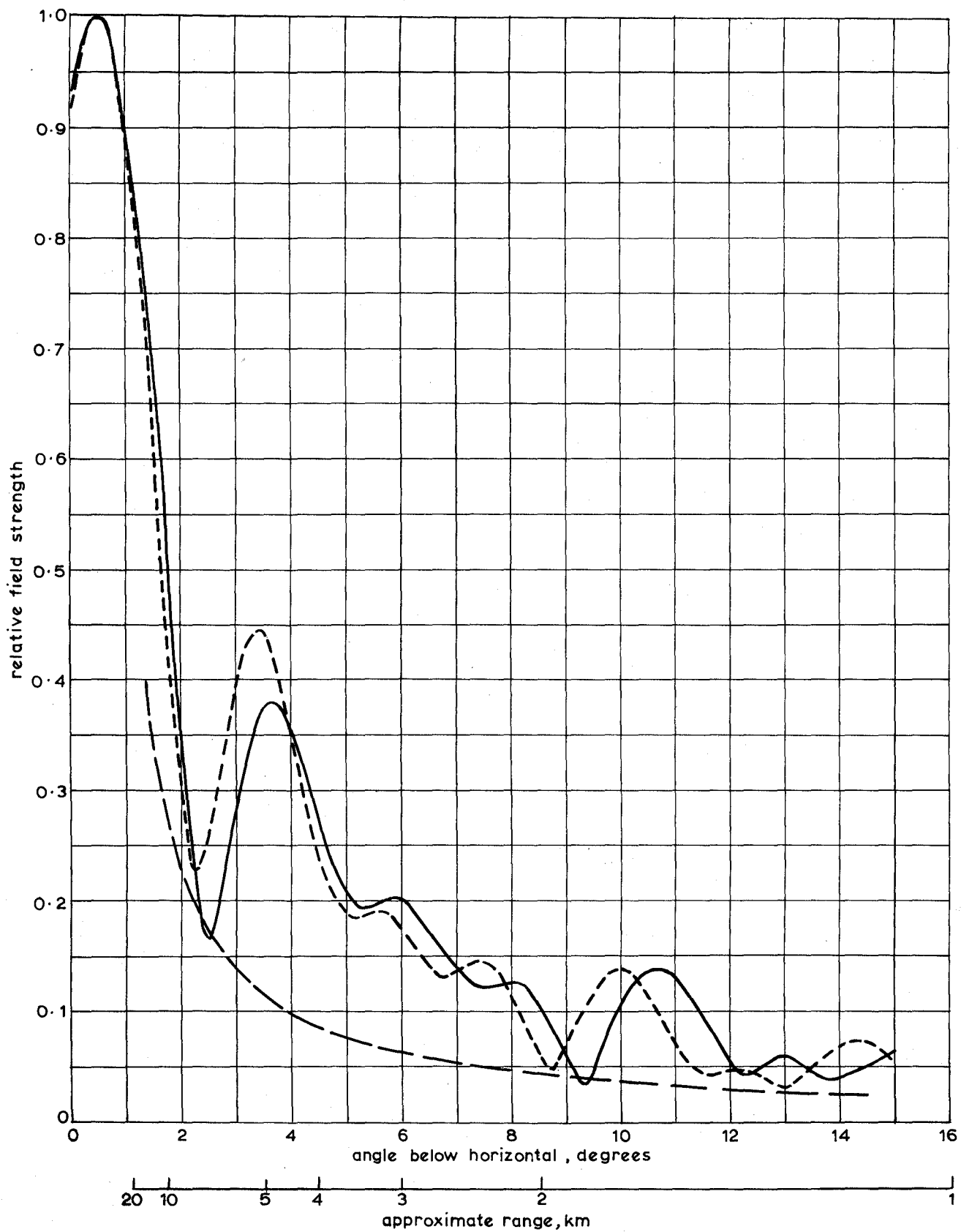


Fig.9. Vertical radiation pattern on bearing 92° E.T.N. (Leg D)

————— Channel 40
 - - - - - Channel 46 (BBC 2)
 - . - . - Specified minimum field

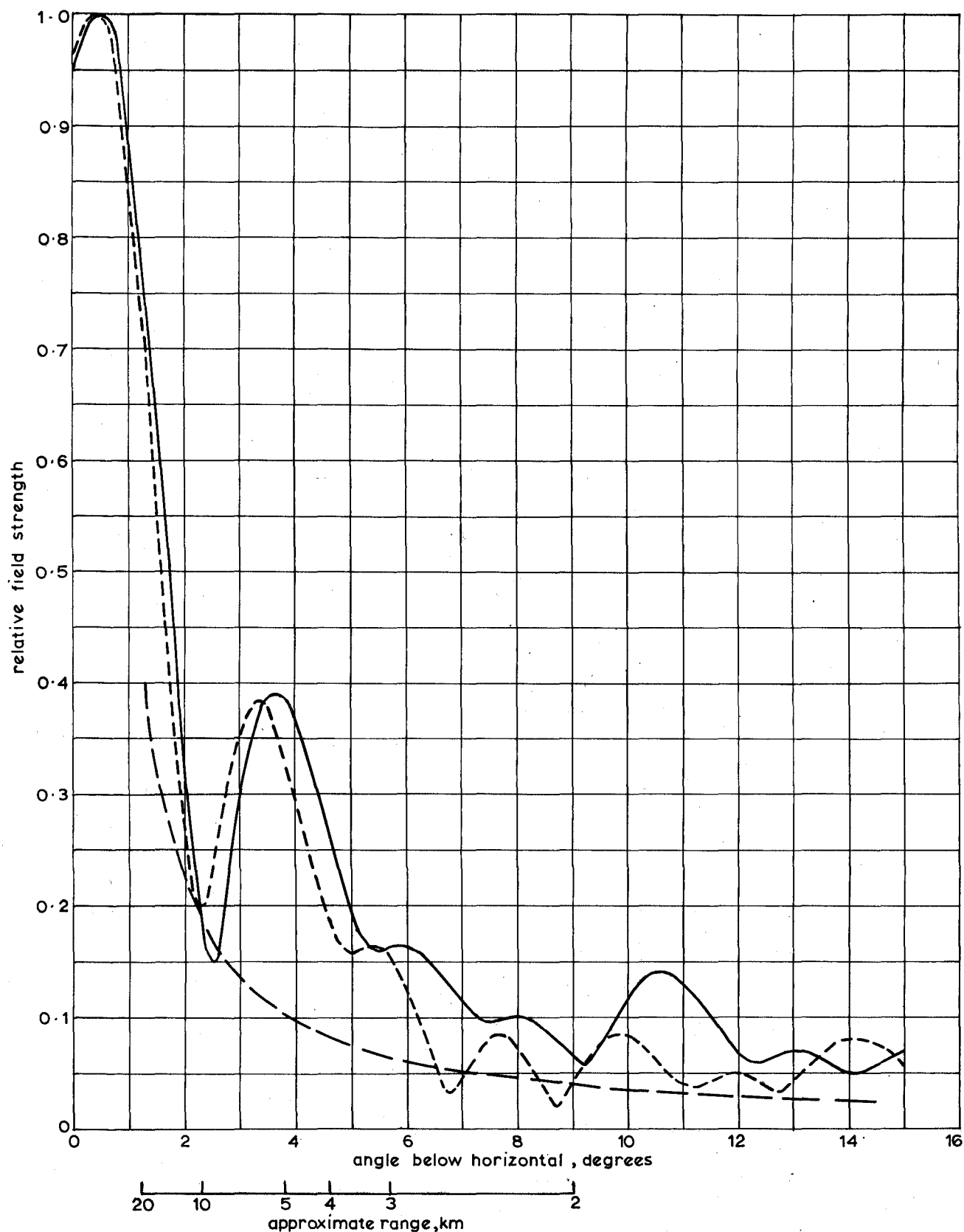


Fig.10. Vertical radiation pattern on bearing 182° E.T.N.(Leg A)

————— Channel 40 - - - - - Channel 46 (BBC2)
 - . - . - . - . - Specified minimum field

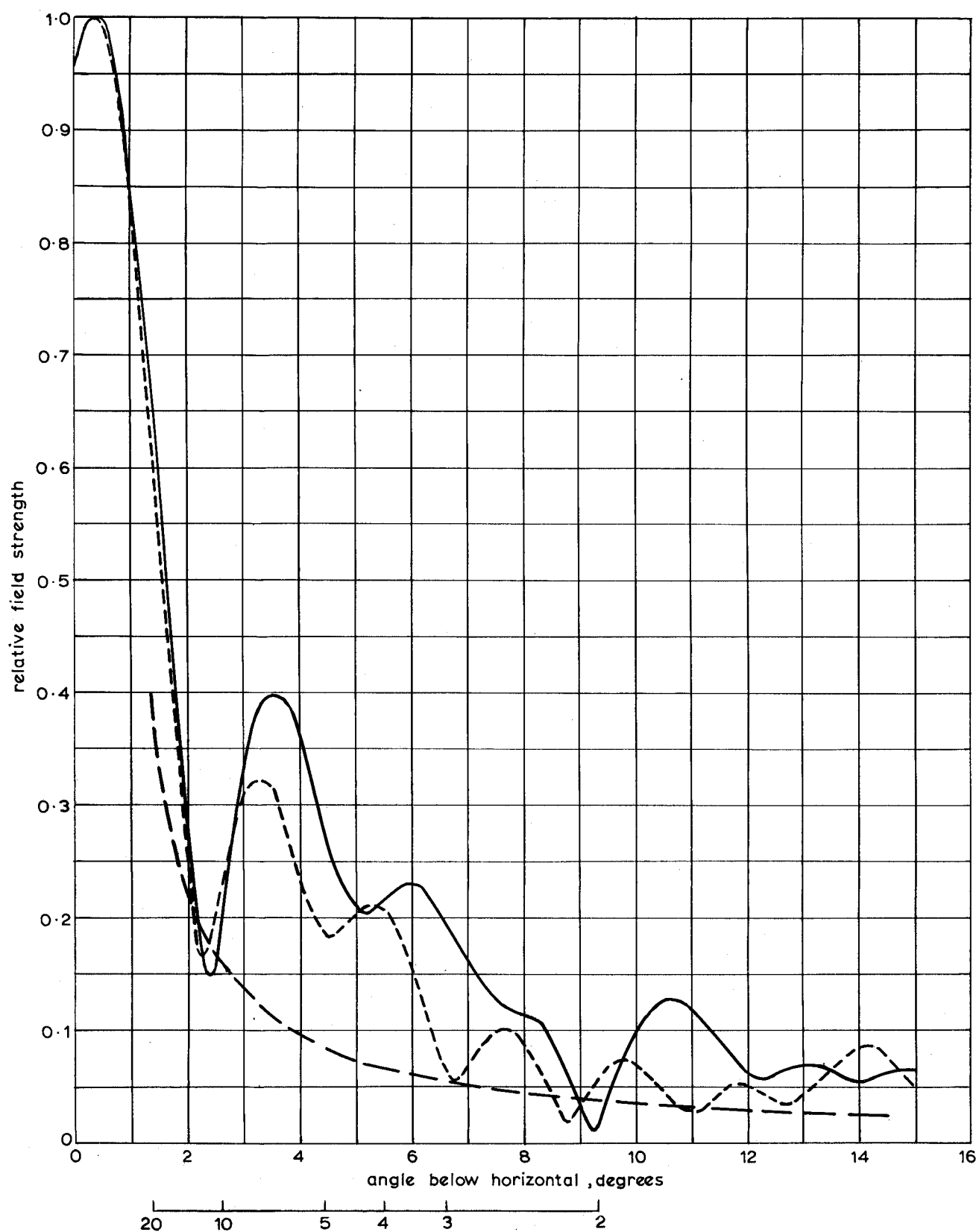


Fig.11. Vertical radiation pattern on bearing 272° E.T.N. (Leg B)
 ————— Channel 40 - - - - - Channel 46 (BBC 2)
 - . - . - . - Specified minimum field

